

# Pediatric Urinary Tract Infections

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# Objectives

- Define epidemiology
- Identify risk factors
- Review methods for diagnosis
- Discuss use of imaging studies
- Summarize treatment options

# Introduction

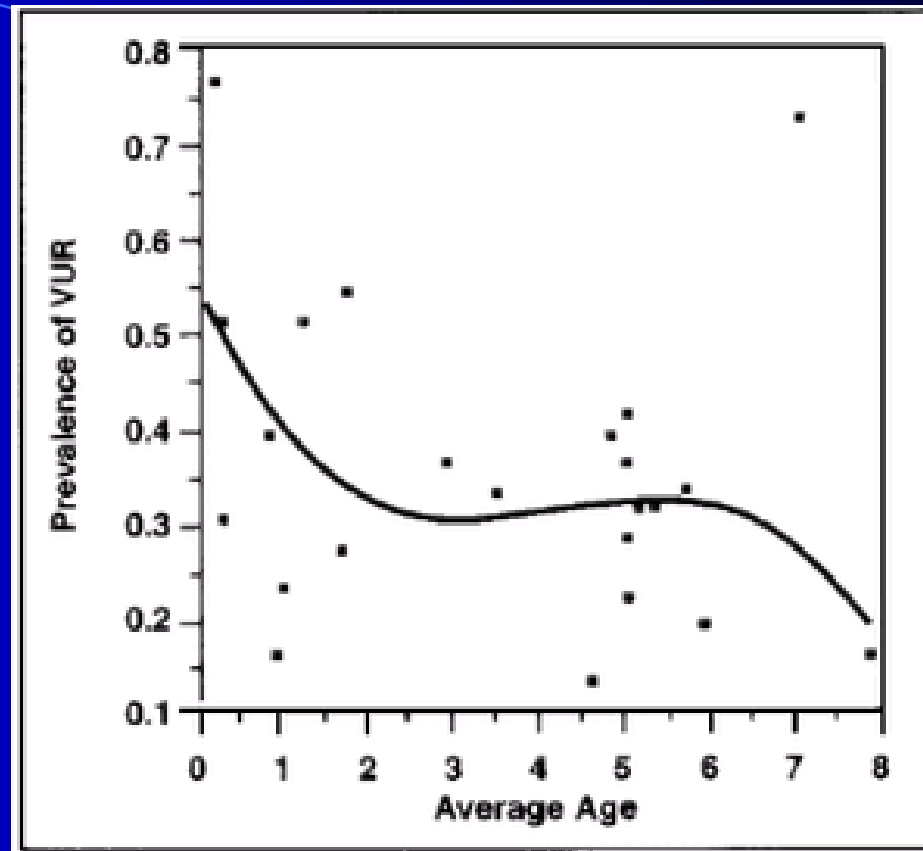
- Pediatric UTIs often signal an underlying genitourinary tract abnormality
- Can lead to renal scarring with resultant hypertension and end stage renal failure
- Difficult to diagnose because symptoms are non-specific in this age group and testing is often invasive

# Pediatric UTIs: Epidemiology

- Prevalence in girls  $<1$  is 6.5%, boys is 3.3%
- Prevalence in girls  $>1$  is 8.1%, boys is 1.9%
- Before age 1, uncircumcised boys have a 10 fold increase in risk compared with circumcised boys
- Occurs in about 7% of children  $<2$  who present with fever without a source

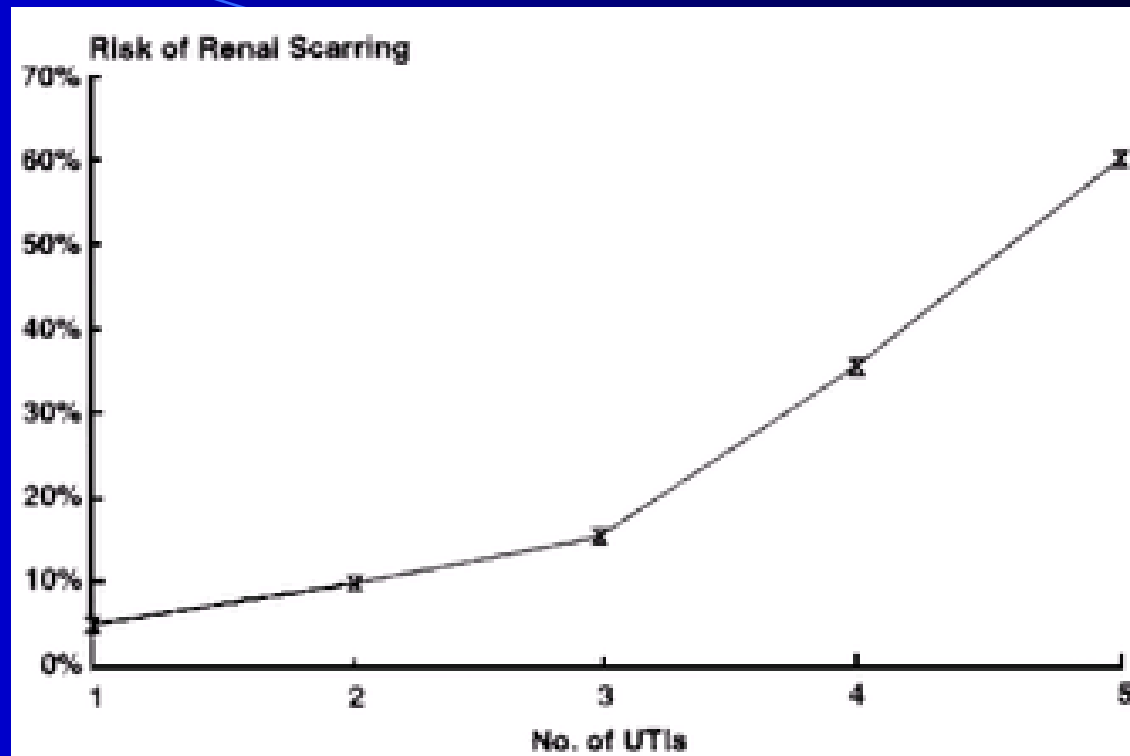
# Epidemiology (continued)

- Incidence and severity of vesicoureteral reflux is highest in age <2
- Early renal scarring is nearly twice as common in this age group
- Incidence of scarring increases with each subsequent UTI



## Figure 1

Prevalence of VUR by age. Plotted are the prevalence reported in 54 studies of urinary tract infections in children (references in Technical Report).



**Figure 2**

Relationship between renal scarring and number of urinary tract infections.<sup>16</sup>

# Pathogenesis

- Access to GU tract include ascending, hematogenous, lymphatic and direct extension
- Most common pathogens include enteric gram-negative bacilli, *Enterobacter*, *Klebsiella* and *Proteus* spp



# Diagnosis

- REQUIRES URINE CULTURE!
- Urinalysis – helpful to determine risk
- Clinical signs and symptoms are non-specific, particularly in age <2

# Risk Factors

- Age <1 year
- Female gender
- Uncircumcised males
- Constipation
- Voiding dysfunction
- Improper wiping
- Genitourinary abnormalities
- Colonization with virulent E. Coli

# Signs and Symptoms - Newborns (<2 months)

- Fever
- Jaundice
- Sepsis
- Failure to thrive
- Vomiting

# Signs and Symptoms - Children <2

- Fever
- Vomiting and/or diarrhea
- Abdominal Pain
- Failure to thrive
- Malodorous urine
- Crying on urination

# Signs and Symptoms - Children >2

- Fever
- Vomiting and/or diarrhea
- Abdominal pain
- Malodorous urine
- Frequency and/or urgency
- Dysuria
- New incontinence

# Urine Collection: Suprapubic Aspirate

- “Gold standard” - >99% specificity
- Percutaneously aspirating the bladder with a 22g needle 1-2 cm above the pubic symphysis
- Positive culture: any number of g-bacilli or >3000 CFU of g+ cocci

# Urine Collection: Transurethral Catherization

- $>10^5$  CFU - 95% specificity
- $10^4 - 10^5$  CFU - infection is likely
- $10^3 - 10^4$  CFU - Suspicious
- $<10^3$  CFU - infection unlikely

# Urine Collection: Bagged or Clean Catch

- Contamination rate of 10%
- Not to be performed in acutely ill child
- $>10^5$  CFU – infection likely
- $10^4 - 10^5$  CFU – suspicious
- $<10^4$  – infection unlikely



# Urinalysis

- Helpful in the child who is not acutely ill
- Can be performed on urine collected by most convenient method
- If positive, requires a specimen obtained by SPA or catheterization for culture

**Table 1. Sensitivity and Specificity of Components of the Urinalysis, Alone and in Combination (References in Text)**

<b>Test</b>	<b>Sensitivity % (Range)</b>	<b>Specificity % (Range)</b>
<b>Leukocyte esterase</b>	<b>83 (67-94)</b>	<b>78 (64-92)</b>
<b>Nitrite</b>	<b>53 (15-82)</b>	<b>98 (90-100)</b>
<b>Leukocyte esterase <i>or</i> nitrite positive</b>	<b>93 (90-100)</b>	<b>72 (58-91)</b>
<b>Microscopy: WBCs</b>	<b>73 (32-100)</b>	<b>81 (45-98)</b>
<b>Microscopy: bacteria</b>	<b>81 (16-99)</b>	<b>83 (11-100)</b>
<b>Leukocyte esterase <i>or</i> nitrite <i>or</i> microscopy positive</b>	<b>99.8 (99-100)</b>	<b>70 (60-92)</b>

# Treatment - <2 months, toxic or dehydrated

- Requires parenteral treatment and likely hospitalization
- Broad spectrum coverage initially including ampicillin and aminoglycoside or 3<sup>rd</sup> generation cephalosporin
- Continue parenteral treatment until afebrile and clinically stable
- Complete a 7-14 day course of antibiotics

# Treatment - >2 months, non-toxic and clinically stable

- May initiate treatment either orally or parenterally
- Oral antibiotic choices include a sulfonamide-containing antimicrobial, amoxicillin, or a cephalosporin
- If not having expected clinical response in 2 days, re-culture and re-evaluate
- Complete 7-14 day course of antibiotics

# Prophylaxis

- After completion of initial antibiotics, children should be give a prophylactic dose of antibiotics until imaging studies complete
- Antibiotic should have high urinary excretion and low serum and fecal levels, thus minimizing the development of resistance.

# Imaging

- Needs to be performed in all children <2 years old with initial UTI
- Need to perform at least 2 studies to image the upper and lower urinary tracts
- Acute imaging only necessary when appropriate clinical response is not achieved within 2 days, or pt has known urinary tract abnormality

# Ultrasound

- Used to examine the kidneys for hydronephrosis, examine the ureters for dilatation, examine the bladder for hypertrophy, ureterocele and other abnormalities
- Has essentially replaced IVP
- Cannot rule out reflux
- Is not as sensitive as renal cortical scintigraphy (DMSA) for detecting inflammation and scarring

# Voiding Cystourethrography (VCUG)

- Useful for identifying and grading reflux
- Also evaluates the urethra and bladder for abnormalities – important for boys who may have posterior urethral valves and girls with voiding dysfunction
- Radionuclide cystography (RNC) – can also evaluate reflux, but does not delineate the lower tract anatomy well. Can be used for follow-up exams



# Renal Cortical Scintigraphy (DMSA)

- Very sensitive for evaluating acute inflammation resulting from pyelonephritis as well as renal scarring
- Role in clinical management is still unclear

# Summary

- Urinary tract infections are a common cause of fever without a source in children and can lead to renal scarring, HTN or ESRD
- Symptoms are non-specific and thus a high level of suspicion is required
- Urine culture is required for diagnosis, and should be obtained by catheterization or SPA when child is ill or infection is suspected
- Treatment requires a 7-14d course of antibiotics
- Prophylactic abx are required after initial treatment
- All Children <2 require 2 imaging studies after initial UTI

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